REMARKS

The subject invention relates to the use of grating targets to optically monitor overlay registration during the fabrication of layers on a semiconductor sample. In accordance with claim 1, the overlay target includes two test patterns. Each test pattern has a grating with the same line pitch. Each test pattern has an offset bias associated therewith, the offset bias being the difference in registration between the upper and lower grating layers. In one preferred embodiment, the preferred offset bias is equal to the line pitch divided by eight.

As also defined in claim 1, there is a specific relationship between the offset bias of the first test pattern and the offset bias of the second test pattern. This offset difference is equal to the line pitch divided by four. This offset **difference** between the two targets should not be confused with the actual offset bias of the layers of either of the two targets. Thus, (and although not preferred) claim 1 could be satisfied if the offset bias of the first target was designed to be one-quarter pitch and the offset bias of the second target was designed to be zero.

The benefit to this approach is to avoid measurement dead spots for all values of overlay misalignment which can occur during fabrication of the layers. More specifically and as described in the subject specification, even if the actual misalignment of the layers results in one of the two targets falling into a measurement dead zone, the remaining target would in fact have a combined offset (intended offset bias plus the offset resulting from the misalignment created during the fabrication process) that would produce maximum sensitivity. (See specification, page 11, lines 10 to 17). As a result, if both targets are measured, at least one of the targets will always provide useful information. As noted in the abstract, "the combined optical response of the test patterns is sensitive to overlay for all values of overlay." Claim 1 has been amended to make this more clear.

As noted in the specification at page 11, line 30+, the useful measurement range provided by the targets of the subject invention is limited to ± pitch/2. While the subject test patterns provided "sensitivity" at all values of overlay alignment, the results will be ambiguous beyond ±pitch/2. As noted in the specification, the subject targets double the useful range over the prior art. One skilled in the art would also understand that sensitivity will be lost in cases of extreme misalignment such as when there is an insufficient overlap of the gratings.

In the Office Action, claims 1 to 4 were rejected as being obvious based on Brill (WO 02/25723). Brill discloses the use of grating test patterns to monitor lateral shifts (overlay

alignment errors) associated with the fabrication of semiconductors. Brill teaches, for example, that one test pattern can have a shift S equal to $+\Delta X$ and the second pattern can have a shift S equal to $-\Delta X$. On page 7, line 25, he suggests using a plurality of test patterns, with nominal shifts $-\Delta X-3\Delta x$, $-\Delta X-2\Delta x$, $-\Delta X-\Delta x$, $-\Delta X$, $-\Delta X-+\Delta x$, $-\Delta X+2\Delta x$, $-\Delta X+3\Delta x$ etc. However, nowhere does Brill suggest that the difference of the offset bias between the first and second test patterns should be equal to the line pitch divided by four.

In the Office Action, the Examiner suggests that Brill teaches an offset bias of one eighth, relying on Figure 5 and page 10. However, Figure 5 is simply a parametric study showing changes in "sensitivity" to a 1nm overlay shift as the Al grating height and grating period are varied for a **single grating**. One skilled in the art would look to Figure 5 to pick a particular grating period and AL grating height which maximizes sensitivity for a 1nm shift for a **single grating structure**. It is submitted that Figure 5 of Brill fails to suggest that one would select an offset bias of one eighth even for if one were hoping to maximize sensitivity for a **single** grating for a single alignment error (1nm). More importantly, Figure 5 does not teach that one can maximize sensitivity to **all values of overlay** from the **combined optical responses of <u>two</u> targets** if the difference in offset bias between the two test patterns is selected to be equal to the line pitch divided by four.

In the Office Action, paragraph 6, the Examiner objected to applicants' arguments as not being reflected in the claim language. In response, applicants have amended claim 1 to better track the arguments and differences over Brill. In view of the amendments to claim 1 and the arguments set forth above, it is submitted that Brill fails to anticipate or render obvious amended claim 1.

In the Office Action, the Examiner rejected claim 5 in further view of the patent to Niu (6,855,464). Niu was cited for its teaching of three grating patterns in three different angular orientations. It is submitted that the Niu patent fails to overcome the deficiencies of Brill in anticipating or rendering obvious amended claim 1.

For the reasons set forth above, it is respectfully submitted that amended claim 1 defines patentable subject matter and allowance thereof, along with the claims depending therefrom is respectfully solicited.

Respectfully submitted,

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